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ABSTRACT

Computer programs written in BASIC for the study of microeconomic analysis with special emphasis in economic decisions on price, output, and profit of a business firm are described. A very brief overview of the content of each of the 28 computer programs comprising the course is provided; four of the programs are then discussed in greater detail. The first program discussed illustrates a demand function. The program is presented in a simple manner so that even students who have never touched a computer terminal can easily learn to use the computer and run the program. The second computer program described deals with the interaction of demand and supply and the effect of change in demand and/or supply upon equilibrium price and resource allocation. The third program deals with the derivation of a consumer's demand schedule by the utility indifference curve approach. The purpose of the fourth computer program described is to bring together both the sales and production functions into one unified general program for making economic decisions on price and output for profit, break-even, and shut-down conditions in the short run. For each program there are charts outlining program commands and sample printouts. (RM)

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MICROECONOMIC ANALYSIS WITH BASIC

by
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Annville, Pennsylvania

March 1984

SP 016 345

Paper presented at the Annual Meeting of the Eastern Economic Association (10th, New York City, March 15-17, 1984).

MICROECONOMIC ANALYSIS WITH BASIC

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As a branch of the social sciences, economics deals with the problems of (1) optimum allocation of relatively scarce resources, (2) full employment of resources with a high level of national income and a stable price, and (3) stable growth of an economy for maximum human well-being.

Within this broad concept of economics, Microeconomic Analysis deals mainly with the first economic problem. Traditionally and without the availability of computers, Microeconomic Analysis employs mutually supportive methods of verbal discussion, numerical example, graphical presentation, and mathematical application. But since computer language and computer facilities, including microcomputers, have now become widely used and easily available on campuses and elsewhere, Microeconomic Analysis can be better understood and become more meaningful if computer programming is added to the traditional method of instruction.

The purpose of this paper, therefore, is to share with you my experiment to introduce the application of computer programs in BASIC into the study of Microeconomic Analysis with special emphasis in economic decisions on price, output, and profit of a business firm.

The organization of the material is traditional. It includes an introductory discussion on the interaction of

demand and supply, the theory and nature of demand and production, and the economic decisions of a firm on output, price, and profit.

It is within this well-tested approach that twenty-eight programs involving one hundred seventy-three exercises are introduced. Confronted with the economic problem of optimum allocation of relatively scarce resource in space and time, I shall first present a brief overview of my materials and then discuss only a few of my programs in greater detail.

I.

Illustration 1 is a Table of Contents showing my general approach and the organization of my computer programs. To begin the study of microeconomics, computer programs for the demand function, the supply function, and the effect of the interaction of demand and supply upon price and resource allocation are introduced. (Chapter I).

For the theory of consumer's demand, two programs are used. One shows the classical diminishing marginal utility approach (Chapter II), and the other illustrates the indifference curves approach (Chapter III).

Moving from consumer's demand to seller's demand (Chapter IV), two types of sales conditions are presented. One program models the sales schedule with a constant sales price, and the other with an inverse relation between sales price and quantity sold.

To complete our study on demand, programs dealing with total demand, change in demand, cross elasticity, income elasti-

city, and price elasticity of demand are presented, (Chapter V).

After the study of demand, the analysis on supply follows. To begin, three programs are used to clarify the difference between real and monetary costs, fixed and variable costs, and explicity and implicit costs. (Chapter VI). For the analysis on the input-output relationship in the short-run, a program is constructed in such a manner that it is possible to deal with not only the special condition of constant marginal productivity but also the more general behavior of production under increasing-decreasing marginal returns. (Chapter VII).

To complete our study on the theory of production, a program designed to illustrate the transition from short-run cost conditions to input-output relations in the long-run is introduced. (Chapter VIII).

As the students have by now been exposed to the theory of demand and production, I push forward to analyze the rationale of making economic decisions by a firm. (Chapter IX). One program deals with break-even decisions, one with maximum total profit (or minimum total loss) decision, and the third with shut-down decisions.

With the above foundation on the general principles of economic decisions, I proceed to complete the entire analytical structure on microeconomics in terms of economic decisions on output, price, and profit of a business firm.

Since there are two types of sales schedule and two conditions on the cost of production, the matrix of combining sales

and costs for decisions is four. Furthermore, since economic decisions can be approached from either (1) comparing total revenue with total cost or, (2) relating average-marginal revenue with average-marginal cost, there are two ways of decision making under each of the four models.

Model I assumes constant sales price and constant marginal returns, a special condition. (Chapter X). There are three computer programs for this model. The first program is to show the total approach with equations for total revenue and total cost. The next program is to illustrate the average-marginal approach with equations for average revenue, marginal revenue, average fixed cost, average variable cost, average cost, and marginal cost. The third one being most comprehensive differs from the previous two programs in three ways. First, it provides both total approach and average-marginal approach to economic decisions. Second, instead of relying only upon equations for revenue and costs in monetary terms, this third program begins with real costs and thus allows the input of any suggested amount of fixed and variable factors of production as well as any price (cost) for each unit of factor of production paid by the firm. Furthermore, this program also permits the flexibility that any data on sales price for each level of production for sales can be entered.

Madel II assumes a sales condition of inverse relation between price and quantity sold and a production function under constant marginal returns. (Chapter XI).

Model III assumes that the price remains constant at all level of sales but that the cost of production is subject to the behavior of the law of diminishing marginal productivity. (Chapter XII).

Finally, Model IV assumes that the price and the volume of sales have an inverse relation and that the marginal returns are variable. (Chapter XIII).

Since the three programs referred to earlier for Model I are constructed in a general form, all three of them can also be used for presenting revenue and cost data for analyzing economic deceions under Model II, Model III, and Model IV.

II.

Limited space and time do not permit me to examine each of the twenty-eight programs, I shall discuss only four of them in greater detail.

The first program I wish to share with you is to illustrate a demand function, coded as I-A in the Table of Contents. This program is purposely presented in a very simple manner so that even students who have never touched a computer terminal before can easily learn to use the computer and run the program with an immediate feeling of success.

As shown in Illustration 2, a linear program for demand is first listed for inspection and then run to demonstrate a schedule showing the quantities of X consumed at various prices. In order to show a different demand schedule, all that is required for a user to do is to change two statements in the program. As shown in Illustration 3, Statement 40 is for a new set of prices,

and Statement 50 is for a new demand function. After the computer is commanded to run the program, a completely new set of data on demand is printed out for observation.*

Illustration 4 is the exercise for this program. Based on my students' reports, they had encountered no difficulty in running the program. But as the garbage-in-garbage-out consequence prevails in running computer programs even as simple as this one, one has to be very careful when data are entered. One of the major by-products of any exercise using the computer is the development of the all important matter of discipline which is regretfully much lacking in the current generation of students.

The second program as shown in Illustration 5 deals with the interaction of demand and supply and the effect of change in demand and/or supply upon equilibrium price and resource allocation. This program, coded I-F in the Table of Contents, is to integrate earlier programs dealing separately with demand, supply, and equilibrium analysis into one unified program. Furthermore, this program will also demonstrate interactions between the computer and the user.

The derivation of the linear demand function is from two

*For convenience in observation, interactions between the computer and the user such as commands given and information entered by the user are underlined in all illustrations whenever appropriate. Also, arrows placed on the left margin pinpointing statements referred to in the text are used.

pairs of coordinates in terms of quantities consumed and their respective prices. In a similar manner, the linear equation for supply is derived. For example, Statement 50 in the program asks for information on two prices. Statement 100 requests data for quantities consumed and Statement 150 for quantities supplied. Statements 200 to 300 provide the necessary calculation to derive the linear demand and supply equations. These two equations will be printed out for observation as commanded by Statements 440 and 480. Based on the above information, the computer is then programmed to solve for equilibrium price and its corresponding quantities consumed and supplied. This is done according to the instruction given in Statements 600 to 620. The computer is then instructed by Statements 660 and 700 to print out the above results for observation.

After providing the information on the amount of factors of production required to produce one unit of output as requested by Statement 730, the allocation of resource to produce the above quantity at equilibrium will be printed out for inspection as commanded by Statements 760 to 766.

To demonstrate what would be the effect of change in demand and/or supply upon equilibrium price, output and resource allocation, any one of the following three choices are provided: (A) a change in demand holding supply constant, (B) a change in supply holding demand constant, or (C) a change in both demand and supply. The computer is then programmed to ask for the choice as instructed by Statement 790.

Depending upon one's choice, the computer is programmed to ask for new data as requested by Statement 850 for change in demand, Statement 920 for change in supply, and by Statement 1020 for change in both demand and supply.

After the computer has been provided with the above new information, the new equilibrium condition for price, output, and resource allocation will be calculated and printed out as instructed by Statements 1874 to 1990 for comparison between the original and the new conditions.

Finally, the program is so designed in that one may either (1) try for an entirely new situation including changes in prices, or (2) try for a change in demand and/or supply, or (3) decide to terminate the program. Statements 2010 to 2050 will instruct the computer to execute one's desire accordingly.

Illustration 6 is the exercise for this program, and Illustration 7 is the printout of the results of an exercise (I-F-1) performed by the computer. As one can observe from the printout that on account of an increase in both demand and supply, the equilibrium price has increased from $4.42553 to $4.47619, the quantity consumed and produced from 23.3191 units to 46.4762 units, and the amount of factors of production from 233.191 units to 464.762 units, representing a movement of resource allocation into this industry by 231,571 units.

The third program coded as III-A in the Table of Contents, deals with the derivation of a consumer's demand schedule by

the utility indifference curve approach. This program is purposely included here for your examination because of its mathematical novelty and peculiarity. Under this program, it is possible to derive a demand schedule with any set of randomly chosen prices simply by entering just one variable in terms of the amount of income which can also be randomly assigned. This is possible however only if a set of very specific assumptions are made. They are (1) that the equation for each of the indifference curves is expressed as X*Y=U with X and Y representing the quantity of X and Y respectively and U the level of utility with a numberical value, and (2) that the price of Y remains constant at $1.

No discussion of the program will be given here other than showing (a) the computer program itself as in Illustration 8 and (b) the printout of the result of executing this program as in Illustration 9. One can observe that, as shown, with the amount of income of $24 and a set of prices of $1, $2, $3, and $4 randomly chosen, four pairs of equations relating to utility indifference curves and expenditure indifference curves as well as the demand schedule for X are printed for evaluation. Interestingly, one can further notice that the price elasticity of demand is always a unity. Graphically, the price consumption curve is a straight line horizontal to the X-quantity axis.

The last program to be shown is coded as X-B, XI-B, XII-B, or XIII-B in the Table of Contents. The purpose of this program

is to bring together both the sales and production functions into one unified general program for making economic decisions by a business firm on price and output for profit, break-even, and shut-down conditions in the short-run. Illustration 10 shows the printout of the computer program. The first part of the program from Statements 42 to 200 is to call for entry of data relating to the production function in both real and monetary terms. Statements 260 to 340 instruct the computer to calculate and printout the real cost of production in terms of the input-output relation between fixed and variable factors of production on the one hand and their corresponding marginal, total, and average output on the other.

Programmed according to Statements 410 to 760, the computer will further calculate and printout the production function in monetary terms. A table showing total fixed cost, total variable cost, total cost, average fixed cost, average variable cost, average cost, and marginal cost related to each level of output will be available for observation.

To bring the revenue aspect into consideration, data on prices that may be possible to sell the different amount of output can now be entered. After the computer has received these given information on price, a printout showing the sales schedule together with data on total revenue, average revenue, and marginal revenue will be available according to instruction given in Statements 810 to 1048.

Based upon the above revenue and cost figures, economic decisions can be made on price and quantity produced and sold for the following conditions: (1) maximum total profit or minimum total loss, (2) range of operation having some total profit other than the maximum or total loss other than the minimum, (3) break-even, (4) loss but not shut-down, and (5) shut-down. These five conditions would cover the entire range of production from zero output to maximum capacity.

Finally, the program also suggests that all the information relating to the monetary cost of production and the estimated sales schedule be plotted on a regular graph paper for study.

Illustration 11 is the printout of the results of this program. One can observe that after different requested data are entered, the computer as instructed will perform the calculations and printout the information on the production function in real terms, the input-output relations in monetary terms, as well as the sales schedule with revenue conditions. Spaces are then provided at the end of the printout to record the decisions made on profit, break-even, and shut-down.

As mentioned earlier in the paper, there are four models in terms of economic decisions of a firm to be considered. To round out this section of the paper, four exercises, one sample for each of the model, are presented herewith for reference. Illustration 12 is related to Model I assuming a constant sales price and a constant marginal return.

Illustration 13 is for Model II which assumes a negatively inclined sales schedule and a constant marginal return. Illustration 14 is related to Model III assuming a constant sales price and a variable marginal return. And Illustration 15 is for Model IV which assumes a negatively inclined sales schedule and a variable marginal return.

By applying this last computer program in analyzing any one of these four models, one is able to consider the economic decision process of a firm not only for all market conditions under perfect competition, imperfect competition, and price regulation by government or industry but also with both the special and the general mode of production.

III.

In conclusion, I would like to make four points. First, since I have incorporated computer programming as part of my instruction since 1979, I am gratified to report that students' responses to this new tool for microeconomics has been favorable. Other than the expected resistance to learning an additional method of analysis from some, better students have found the application of computer programming not only fascinating and intellectually challenging but also a very valuable experience in preparation for their advanced academic studies and future professional activities.

Secondly, whatever I have done so far is only a very modest beginning in introducing computer programming into microeconomic

analysis. There are many other topics that can be related to the application of computer programming. For example, pricing of resources, monopolistic and monoposonistic interaction on wages, a unified program for price determination and resource allocation involving many consumers and many producers in the economic system, and a general equilibrium approach to price, output, and resource allocation.

Third, I have no doubt that computer programming is a very useful and powerful tool in economic analysis. One can easily change many independent variables to observe the changing results immediately, an advantage far beyond what verbal explanation, graphical presentation, and even mathematical exposition can provide. I envision that computer programming will become a standard method of instruction and analysis not only in microeconomics in particular but also in many other fields in economics in general.

Finally, I wish to express my appreciation to the Eastern Economic Association for inviting me to share my experience with you. My attempt is a modest one, and there is a great deal of room for improvement. I stand only at the edge of the frontier on the application of computer programming in economics for better instruction and research. It is my sincere hope that others who know more in economics and computer science than I will join me to push this new frontier forward. I am therefore most eager and grateful to receive your critical comments and suggestions.

Thank you.

15 March 1984

Illustration 1

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XIII-B. A General Model
XIII-C. Decisions on Advertising

Illustration 2

I-A: Demand

```
OLD
Old file name--$DEMAND

Ready

LIST
DEMAND  09:01            83.01.26
1 PRINT
2 PRINT TAB(40) "NAME:";
3 INPUT N$
4 PRINT "PROBLEM NO.";
6 INPUT A$
7 PRINT
10 PRINT "GIVEN A DEMAND SCHEDULE FOR X, FIND THE DIFFERENT"
15 PRINT "QUANTITY OF X CONSUMED AT VARIOUS PRICES."
20 PRINT
30 PRINT "PRICE OF X", "Q OF X CONSUMED"
40 FOR P=1 TO 2.0 STEP .1
50 LET D=100 - 5*P
60 PRINT P, D
70 NEXT P
80 END

Ready

RUN
DEMAND  09:01            83.01.26

                                        NAME:? CFJI
PROBLEM NO.? I-A

GIVEN A DEMAND SCHEDULE FOR X, FIND THE DIFFERENT
QUANTITY OF X CONSUMED AT VARIOUS PRICES.

PRICE OF X      Q OF X CONSUMED
 1               95
 1.1             94.5
 1.2             94
 1.3             93.5
 1.4             93
 1.5             92.5
 1.6             92
 1.7             91.5
 1.8             91
 1.9             90.5

Ready
```

Illustration 3

I-A: Demand

```
OLD
Old file name--$DEMAND

Ready

LIST
DEMAND  09:03              83.01.26
1 PRINT
2 PRINT TAB(40) "NAME:";
3 INPUT N$
4 PRINT "PROBLEM NO.";
6 INPUT A$
7 PRINT
10 PRINT "GIVEN A DEMAND SCHEDULE FOR X, FIND THE DIFFERENT"
15 PRINT "QUANTITY OF X CONSUMED AT VARIOUS PRICES."
20 PRINT
30 PRINT "PRICE OF X", "Q OF X CONSUMED"
40 FOR P=1 TO 2.0 STEP .1
50 LET D=100 - 5*P
60 PRINT P, D
70 NEXT P
80 END

Ready

→ 40 FOR P=.5 TO 10 STEP .5
→ 50 LET D=30-.4*P
RUN
DEMAND  09:03              83.01.26

                                        NAME:? CFJI

PROBLEM NO.? I-A-1

GIVEN A DEMAND SCHEDULE FOR X, FIND THE DIFFERENT
QUANTITY OF X CONSUMED AT VARIOUS PRICES.

PRICE OF X      Q OF X CONSUMED
 .5              29.8
 1               29.6
 1.5             29.4
 2               29.2
 2.5             29
 3               28.8
 3.5             28.6
 4               28.4
 4.5             28.2
 5               28
 5.5             27.8
 6               27.6
 6.5             27.4
 7               27.2
 7.5             27
 8               26.8
 8.5             26.6
 9               26.4
 9.5             26.2
 10              26
```

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Illustration 4

I-A: Demand

* Computer program name: #DEMAND
* Given a demand schedule for a commodity, find the different quantity of commodity consumed at various prices.

NO.	Price (P)	Demand Schedule
IA 1	From $.50 to $10 with $.50 interval	D = 30 - .4P
IA 2	From $100 to $200 with $12.50 interval	D = 400 - .8P
IA 3	From $1 to $2 with $.05 interval	D = 86 - 2.3 x P
IA 4	Your choice	Your choice

Note:

1. After READY, type LIST, if you want to see how the program looks like.
2. Use Statement 40 for different prices. For example, type: 40 For P = .5 to 10 STEP .5 as in 1-A-1 above.
3. Use Statement 50 for demand schedule. For example, type: 50 let D = 30 - .4*P as in 1-A-1 above.
4. Type RUN to execute the program.

Illustration 5

I-F: Changes in Demand, Supply, and Resource Allocations

```
NOVA/L  08:18          83.02.07
 1 PRINT
 2 PRINT TAB(40) "NAME:";
 3 INPUT N$
 4 PRINT
 5 PRINT "PROBLEM NO.:";
 6 INPUT N1
 8 PRINT
10 PRINT "TO FIND THE EFFECTS OF CHANGES IN DEMAND AND/OR SUPPLY "
12 PRINT "UPON THE EQUILIBRIUM PRICE,QUANTITY,AND RESOURCE ALLOCATION."
20 PRINT
30 PRINT "WITH PRICES P1 AND P2 BEING:"
→50 INPUT P1,P2
60 PRINT
70 PRINT "AND WITH QUANTITY CONSUMED, D1 AND D2, AT P1 AND P2"
72 PRINT "RESPECTIVELY BEING:"
→100 INPUT D1,D2
120 PRINT
130 PRINT "AND WITH QUANTITY SUPPLIED, S1 AND S2, AT P1 AND P2"
132 PRINT "RESPECTIVELY BEING:"
→150 INPUT S1,S2
200 LET D3=D1-D2
210 LET P3=P1-P2
→220 LET A=D1-(D3*P1)/P3
230 LET B=D3/P3
290 LET N=(S1-S2)/(P1-P2)
300 LET M=S1-(N*P1)
410 PRINT
420 PRINT "THE LINEAR DEMAND FUNCTION WOULD BE:"
430 PRINT
→440 PRINT TAB(5);"D=";A;"+";B;"*P"
450 PRINT
460 PRINT "AND THE LINEAR SUPPLY FUNCTION WOULD BE:"
470 PRINT
→480 PRINT TAB(5);"S=";M;"+";N;"*P"
490 PRINT
500 PRINT "BASED ON THE ABOVE DEMAND AND SUPPLY FUNCTIONS,"
510 PRINT "THE EQUILIBRIUM PRICE, QUANTITY CONSUMED AND"
530 PRINT "QUANTITY SUPPLIED WOULD BE:"
600 LET P=(M-A)/(B-N)
→610 LET D=A+B*P
620 LET S=M+N*P
630 PRINT
→660 PRINT "EQM PRICE", "Q CONSUMED", "Q SUPPLIED"
→700 PRINT P,D,S
710 PRINT
720 PRINT "ASSUME THAT THE AMOUNT OF FACTORS OF PRODUCTION (F)"
722 PRINT "REQUIRED TO PRODUCE ONE UNIT OF GOODS IS:";
→730 INPUT F
740 LET X=S*F
750 PRINT
760 PRINT "THEN THE ALLOCATION OF RESOURCE TO PRODUCE THE ABOVE"
→762 PRINT "EQUILIBRIUM AMOUNT OF GOODS OF"; S; "UNITS "
766 PRINT "WOULD BE"; X; "UNITS OF FACTOR OF PRODUCTION."
```

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Illustration 5

(continued)

```
RESALL  08:20          83.02.09
770 PRINT
780 PRINT 'NOW SUPPOSE THERE IS EITHER A CHANGE IN (A) DEMAND HOLDING'
784 PRINT 'SUPPLY CONSTANT, OR (B) SUPPLY  HOLDING DEMAND CONSTANT'
786 PRINT 'OR (C) BOTH DEMAND AND SUPPLY.  SELECT ONE OF THEM BY '
788 PRINT 'TYPING  A, OR B, OR C.:
790 INPUT Z$
800 IF Z$='A' THEN 830
810 IF Z$= 'B' THEN 900
820 IF Z$= 'C' THEN 1000
821 LET W=0
822 LET W=W+1
824 PRINT  'YOU MUST TYPE A, B, OR C.'
826 IF W>3 THEN 3000 ELSE 790
830 PRINT
840 PRINT 'WITH A CHANGE IN DEMAND IN D1 AND D2 AS FOLLOWS:'
850 INPUT D1, D2
860 GOTO 1860
900 PRINT
910 PRINT 'WITH A CHANGE IN SUPPLY IN S1 AND S2 AS FOLLOWS:'
920 INPUT S1, S2
930 PRINT
940 GOTO 1860
1000 PRINT
1010 PRINT 'WITH A CHANGE IN BOTH DEMAND AND SUPPLY IN D1, D2,'
1014 PRINT 'S1, AND S2 AS FOLLOWS:'
1020 INPUT D1,D2,S1,S2
1030 GOTO 1860
1860 PRINT
1870 PRINT 'WE NOW WILL HAVE THE NEW EQUILIBRIUM CONDITIONS FOR:'
1872 PRINT
1874 PRINT 'PRICE', 'Q DEMANDED', 'Q SUPPLIED', 'RESOURCE ALLOCATION'
1880 LET D3=D1-D2
1890 LET P3=P1-P2
1900 LET A=D1-(D3*P1)/P3
1910 LET B=D3/P3
1920 LET N=(S1-S2)/(P1-P2)
1930 LET M=S1-(N*P1)
1940 LET P=(M-A)/(B-N)
1950 LET D=A+B*P
1960 LET S=M+N*P
1970 LET X=S*F
1980 PRINT
1990 PRINT P,D,S,X
```

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Illustration 5
(concluded)

```
RESALL  08:21            83.02.09
2000 PRINT
2010 PRINT 'TRY AGAIN? (1) FOR AN ENTIRELY NEW SITUATION INCLUDING'
2012 PRINT 'CHANGE IN PRICES, TYPE AA.  (2) FOR CHANGES IN DEMAND'
2014 PRINT 'AND/OR SUPPLY, TYPE BB. (3) NO MORE TRY, TYPE NO.:
2020 INPUT Y$
2022 PRINT
2023 PRINT
2025 IF Y$='NO' THEN 3000
2030 IF  Y$='AA' THEN 2032
2032 PRINT 'PROBLEM NO:';
2034 INPUT A$
2036 GOTO 20
2040 IF Y$='BB' THEN 2042
2042 PRINT 'PROBLEM NO:';
2044 INPUT A$
2046 GOTO 770
2050 IF Y$='NO' THEN 3000
3000 END

Ready
```

```
BYE
Confirm: Y
Saved all disk files: 284 blocks in use, 216 free
Job 16 User 140,0 logged off KB25 at 83.02.09  08:21
System RSTS V7.0-07 Lebanon Valley
Run time was 10.4 seconds
Elapsed time was 6 minutes
Good morning
```

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IF: CHANGES IN DEMAND, SUPPLY, AND RESOURCE ALLOCATIONS

* Computer Program Name: *RESALL
* To find the effect of changes in demand and/or supply upon the equilibrium price, quantity and resource allocations.

NO.		IF 1	IF 2	IF 3
P1		4	2	
P2		9	9	
Original	D1	24	9	
	D2	16	2	
	S1	20	2	
	S2	59	9	
Amount of factor of productivity to produce one unit of goods		10	10	
Change in demand and/or supply: A, or B, or C		C	B	
New	D1	48	no change	
	D2	32	no change	
	S1	40	4	
	S2	108	18	
Net change in resource allocation				

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Illustration 7

I-F: Changes in Demand, Supply, and Resource Allocations

```
OLD
Old file name--RESALL

Ready

RUN
RESALL  10:02                83.03.07

                                        NAME:? CFJI

PROBLEM NO.:? I-F-1

TO FIND THE EFFECTS OF CHANGES IN DEMAND AND/OR SUPPLY
UPON THE EQUILIBRIUM PRICE,QUANTITY,AND RESOURCE ALLOCATION.

WITH PRICES P1 AND P2 BEING:
? 4
? 9

AND WITH QUANTITY CONSUMED, D1 AND D2, AT P1 AND P2
RESPECTIVELY BEING:
? 24
? 16

AND WITH QUANTITY SUPPLIED, S1 AND S2, AT P1 AND P2
RESPECTIVELY BEING:
? 20
? 59

THE LINEAR DEMAND FUNCTION WOULD BE:

     D= 30.4 +-1.6 *P

AND THE LINEAR SUPPLY FUNCTION WOULD BE:

     S=-11.2 + 7.8 *P

BASED ON THE ABOVE DEMAND AND SUPPLY FUNCTIONS,
THE EQUILIBRIUM PRICE, QUANTITY CONSUMED AND
QUANTITY SUPPLIED WOULD BE:

EQM PRICE      Q CONSUMED     Q SUPPLIED
 4.42553        23.3191        23.3191

ASSUME THAT THE AMOUNT OF FACTORS OF PRODUCTION (F)
REQUIRED TO PRODUCE ONE UNIT OF GOODS IS:? 10

THEN THE ALLOCATION OF RESOURCE TO PRODUCE THE ABOVE
EQUILIBRIUM AMOUNT OF GOODS OF 23.3191 UNITS
WOULD BE 233.191 UNITS OF FACTOR OF PRODUCTION.

NOW SUPPOSE THERE IS EITHER A CHANGE IN (A) DEMAND HOLDING
SUPPLY CONSTANT, OR (B) SUPPLY  HOLDING DEMAND CONSTANT
OR (C) BOTH DEMAND AND SUPPLY.  SELECT ONE OF THEM BY
TYPING  A, OR B, OR C.:
? C
```

Illustration 7
(concluded)

```
WITH A CHANGE IN BOTH DEMAND AND SUPPLY IN D1, D2,
S1, AND S2 AS FOLLOWS:
? 48
? 32
? 40
? 108

WE NOW WILL HAVE THE NEW EQUILIBRIUM CONDITIONS FOR:

PRICE          Q DEMANDED     Q SUPPLIED     RESOURCE ALLOCATION

 4.47619        46.4762        46.4762         464.762

TRY AGAIN? (1) FOR AN ENTIRELY NEW SITUATION INCLUDING
CHANGE IN PRICES, TYPE AA.  (2) FOR CHANGES IN DEMAND
AND/OR SUPPLY, TYPE BB. (3) NO MORE TRY, TYPE NO.:
? NO

Ready


BYE
Confirm: YES
Saved all disk files; 284 blocks in use, 216 free
Job 12 User 140,0 logged off KB25 at 83.03.07  10:04
System RSTS V7.0-07 Lebanon Valley
Run time was 5 seconds
Elapsed time was 7 minutes
Good morning
```

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Illustration 8

III-A: Utility Indifference Curve Approach to Demand

```
UIC002  12:09            83.02.11
 1 PRINT
 2 PRINT TAB(40) "NAME:";
 3 INPUT N$
 4 PRINT
 5 PRINT "PROBLEM NO.:";
 6 INPUT A$
 7 PRINT
 10 PRINT
 20 PRINT "UTILITY INDIFFERENCE CURVE APPROACH TO DEMAND."
 30 PRINT
 40 PRINT "ASSUME TWO COMMODITIES: X AND Y."
 50 PRINT
 60 PRINT "ASSUME PRICE OF Y, P2,REMAINING CONSTANT AT $1."
 61 PRINT
 62 LET P2=1
 64 PRINT "ASSUME A FAMILY OF UTILITY INDIFFERENCE CURVE (UIC)"
 66 PRINT "REPRESENTING DIFFERENT LEVELS OF UTILITY WILL BE EXPRESSED"
 68 PRINT "IN THE FORM OF X*Y=U."
 70 PRINT
 80 PRINT "IN ORDER TO SET UP PAIRS OF UTILITY INDIFFERENCE CURVE AND"
 82 PRINT " EXPENDITURE INDIFFERENCE CURVE (EIC) FOR THIS"
 84 PRINT "EXERCISE, SELECT RANDOMLY A CERTAIN AMOUNT OF INCOME"
 86 PRINT "TO BE SPENT ON X AND Y:"
 90 INPUT I
 100 PRINT
 110 PRINT "NOW SELECT A RANGE OF PRICE OF X BETWEEN THE FOLLOWING"
 112 PRINT "DOLLAR VALUES:"
 120 INPUT P1,P2
 130 PRINT
 140 PRINT "THEN INDICATE THE INTERVAL VALUE BETWEEN ANY"
 142 PRINT "TWO LEVELS OF PRICE:"
 150 INPUT Z
 160 PRINT
 170 PRINT "WITH THE ABOVE GIVEN INFORMATION, A SET OF PAIRS OF UIC"
 172 PRINT "AND EIC WILL BE SHOWN AS FOLLOWS:"
 175 PRINT
 180 FOR P=P1 TO P2 STEP Z
 190 LET U=((I/2)**2)/P
 200 PRINT TAB(5) "Q*Q2=";U
 210 PRINT TAB(5) "$";P;"*Q+$1*Q2=";I
 220 PRINT
 230 NEXT P
```

Illustration 8
(concluded)

```
UIC002  12:10            83.02.11
240 PRINT
250 PRINT 'WITH THE ABOVE SET OF PAIRS OF UIC AND EIC, THE OPTIMUM'
252 PRINT 'DEMAND CONDITION FOR X CAN BE SHOWN AS FOLLOWS:'
260 PRINT
270 PRINT 'P OF X', 'Q OF X'
280 PRINT '($)','(UNITS)'
290 PRINT
300 FOR P=P1 TO P2 STEP Z
310 LET X=((I/2)/P)
320 PRINT P, X
330 NEXT P
340 PRINT
350 PRINT 'TRY AGAIN? YES? NO?'
355 INPUT W$
360 IF W$='YES' THEN 1
380 IF W$='NO' THEN 500
500 END

Ready
```

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Illustration 9

III-A: Utility Indifference Curve Approach to Demand

```
UTILITY INDIFFERENCE CURVE APPROACH TO DEMAND.

ASSUME TWO COMMODITIES: X AND Y.

ASSUME PRICE OF Y, P2,REMAINING CONSTANT AT $1.

ASSUME A FAMILY OF UTILITY INDIFFERENCE CURVE (UIC)
REPRESENTING DIFFERENT LEVELS OF UTILITY WILL BE EXPRESSED
IN THE FORM OF X*Y=U.

IN ORDER TO SET UP PAIRS OF UTILITY INDIFFERENCE CURVE AND
 EXPENDITURE INDIFFERENCE CURVE (EIC) FOR THIS
EXERCISE, SELECT RANDOMLY A CERTAIN AMOUNT OF INCOME
TO BE SPENT ON X AND Y:
? 24

NOW SELECT A RANGE OF PRICE OF X BETWEEN THE FOLLOWING
DOLLAR VALUES:
? 1
? 1

THEN INDICATE THE INTERVAL VALUE BETWEEN ANY
TWO LEVELS OF PRICE:
? 1

WITH THE ABOVE GIVEN INFORMATION, A SET OF PAIRS OF UIC
AND EIC WILL BE SHOWN AS FOLLOWS:

     Q*Q2= 144
     $ 1 *Q+$1*Q2= 24

     Q*Q2= 72
     $ 2 *Q+$1*Q2= 24

     Q*Q2= 48
     $ 3 *Q+$1*Q2= 24

     Q*Q2= 36
     $ 4 *Q+$1*Q2= 24


WITH THE ABOVE SET OF PAIRS OF UIC AND EIC, THE OPTIMUM
DEMAND CONDITION FOR X CAN BE SHOWN AS FOLLOWS:

P OF X          Q OF X
($)             (UNITS)

 1               12
 2               6
 3               4
 4               3

TRY AGAIN? YES? NO?
? NO
```

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Illustration 10

X-B: Economic Decisions: A General Model from Real Cost to Monetary Cost with An Estimated Sales Schedule

```
MODELA  13:27              83.02.17
 1 PRINT
 2 PRINT TAB(40) "NAME:";
 3 INPUT N$
 4 PRINT
 5 PRINT "PROBLEM NO:";
 6 INPUT B$
 7 PRINT
 10 PRINT
 20 PRINT "ECONOMIC DECISIONS OF A FIRM ON PRICE, QUANTITY PRODUCED"
 22 PRINT "AND SOLD FOR MAXIMUM PROFIT (MINIMUM LOSS), BREAK-EVEN,"
 24 PRINT "LOSS BUT NOT SHUT-DOWN, AND SHUT-DOWN CONDITIONS."
 40 PRINT
 42 PRINT  "ASSUMPTIONS FOR COSTS OF PRODUCTION IN THE SHORT-RUN:"
 44 PRINT
 50 PRINT "(1) ASSUME THAT THE TOTAL AMOUNT OF FIXED FACTORS OF"
 52 PRINT "PRODUCTION (FFP) REQUIRED =";
 60 INPUT F
 70 PRINT "(2) ASSUME  THAT THE PRICE PER UNIT OF FFP=";
 80 INPUT F1
 90 PRINT "(3) ASSUME THAT THE MAXIMUM AMOUNT OF VARIABLE FACTOR OF"
 100 PRINT "PRODUCTION (VFP) THAT THIS FIRM CAN USE WITHOUT"
 110 PRINT "ENCOUNTERING A SMALLER TOTAL PRODUCTION (NEGATIVE"
 120 PRINT "MARGINAL RETURNS)=";
 122 DIM X(100)
 130 INPUT X
 140 PRINT "(4) ASSUME THAT THE PRICE PER UNIT OF VFP=";
 150 INPUT V1
 160 PRINT "(5)ASSUME THAT THE MARGINAL OUTPUT ASSOCIATED WITH EACH "
 170 PRINT "OF THE ADDITIONAL VFP IS AS FOLLOWS:(START WITH ZERO BECAUSE"
 172 PRINT "WITHOUT THE USE OF VFP THERE WOULD BE ZERO OUTPUT.)"
 178 DIM V(100)
 179 DIM Q(100)
 180 FOR V=0 TO X
 190 INPUT Q(V)
 200 NEXT V
 250 PRINT
 260 PRINT "BASED ON THE ABOVE INFORMATION, THE PRODUCTION FUNCTION"
 270 PRINT "IN REAL TERMS FOR THIS FIRM IN TERMS OF MARGINAL OUTPUT"
 272 PRINT "(MO);, TOTAL OUTPUT (TO), AND AVERAGE OUTPUT (AO)"
 274 PRINT "PER UNIT OF VFP CAN BE SHOWN AS FOLLOWS:"
 280 PRINT
 285 PRINT "FFP", "VFP", "MO", "TO", "AO"
 287 PRINT "(UNITS)","(UNITS)","(UNITS)","(UNITS)","(UNITS)"
 288 PRINT
 290 FOR V=0 TO X
 300 LET Q=Q+Q(V)
 302 IF V>0 THEN 310
 304 IF V=0 THEN330
 310 LET W=Q/V
 320 LET W=INT(100*W+.05)/100
 330 PRINT F,V,Q(V),Q,W
 340 NEXT V
```

Illustration 10
(continued)

```
MODELA  13:30            83.02.17
400 PRINT
410 PRINT "FURTHERMORE, BASED ON THE ABOVE DATA, THE PRODUCTION"
420 PRINT "COST IN MONETARY TERMS SUCH AS TOTAL FIXED COST (TFC),"
430 PRINT "TOTAL VARIABLE COST (TVC), TOTAL COST (TC), AVERAGE FIXED"
440 PRINT "COST (AFC), AVERAGE VARIABLE COST (AVC), AVERAGE TOTAL"
450 PRINT "COST (AC), AND MARGINAL COST (MC) FOR DIFFERENT LEVELS"
460 PRINT "OF OUTPUT CAN BE SHOWN AS FOLLOWS:"
470 PRINT
480 PRINT "TO";TAB(6);"TFC";TAB(14);"TVC";TAB(22);"TC";TAB(30);
490 PRINT "AFC";TAB(38);"AVC";TAB(46);"AC";TAB(54);"MC"
494 PRINT "(Q)";TAB(6);"($)";TAB(14);"($)";TAB(22);"($)";TAB(30);
495 PRINT "($)";TAB(38);"($)";TAB(46);"($)";TAB(54);"($)"
500 PRINT
504 LET Q=0
510 FOR V=0 TO X
520 LET T1=F*F1
530 LET T2=V*V1
540 LET T3=T1+T2
550 LET Q=Q+Q(V)
560 IF Q=0 THEN 700
570 LET A1=T1/Q
580 LET A1=INT(100*A1+.05)/100
590 LET A2=T2/Q
600 LET A2=INT(100*A2+.05)/100
610 LET A3=T3/Q
620 LET A3=INT(100*A3+.05)/100
630 LET M=(T2-T4)/(Q-Q1)
635 LET M=INT(100*M+.05)/100
640 LET Q1=Q
650 LET T4=T2
660 PRINT Q;TAB(6);T1;TAB(14);T2;TAB(22);T3;TAB(30);
670 PRINT A1;TAB(38);A2;TAB(46);A3;TAB(54);M
680 NEXT V
690 GOTO 800
700 LET T2=0
710 LET T3=T1
720 LET A1=0
730 LET A2=0
740 LET A3=0
750 LET M=0
760 GOTO 660
800 PRINT
810 PRINT "NOW ESTIMATE SALES PRICE THAT MAY BE POSSIBLE TO SELL"
820 PRINT "THE DIFFERENT AMOUNT OF OUTPUT SHOWN ABOVE:"
830 PRINT
832 DIM P(100)
840 FOR V=0 TO X
850 INPUT P(V)
860 NEXT V
```

Illustration 10
(continued)

```
MODELA  13:30            83.02.17
870 PRINT
880 PRINT "WITH THE ABOVE ESTIMATED SALES SCHEDULE, ITS CORRESPONDING"
890 PRINT "TOTAL REVENUE (TR), AVERAGE REVENUE (AR), AND MARGINAL"
900 PRINT "REVENUE (MR) ASSOCIATED WITH DIFFERENT LEVELS OF SALES"
910 PRINT "CAN BE SHOWN AS FOLLOWS:"
920 PRINT
922 PRINT "PRICE", "QUANTITY", "TR", "AR", "MR"
923 PRINT "($)","(UNITS)","($)","($)","($)"
924 PRINT
926 LET Q=0
930 FOR V=0 TO X
940 REM "TOTAL REVENUE: R1=P(V)*Q."
950 LET Q=Q+Q(V)
960 LET R1=P(V)*Q
964 LET R1=INT(100*R1+.05)/100
970 REM "AVERAGE REVENUE: AR2=P(V)."
980 LET R2=P(V)
984 LET R2=INT(100*R2+.05)/100
990 REM "MARGINAL REVENUE: R3=(R1-R5)/(Q-Q1)."
992 IF Q=0 THEN 1042
1000 LET R3=(R1-R5)/(Q-Q1)
1004 LET R3=INT(100*R3+.05)/100
1010 LET Q1=Q
1020 LET R5=R1
1030 PRINT P(V), Q, R1, R2, R3
1040 NEXT V
1041 GOTO 1050
1042 PRINT P(V),Q,R1,"----","----"
1044 LET Q1=Q
1046 LET R5=R1
1048 GOTO 1040
1050 PRINT
1060 PRINT "BASED ON THE ABOVE REVENUE AND COST CONDITIONS, FIND"
1070 PRINT "SALES PRICE, QUANTITY PRODUCED AND SOLD FOR MAXIMUM"
1080 PRINT "PROFIT (MINIMUM LOSS), BREAK-EVEN OR NEAR-BREAK-EVEN,"
1090 PRINT "LOSS BUT NOT SHUT-DOWN, AND SHUT-DOWN CONDITIONS."
1100 PRINT
1120 PRINT ,,"SALES","QUANTITY OR","PROFIT OR"
1130 PRINT ,,"PRICE","RANGE OF Q","LOSS (-)"
1140 PRINT ,,"($)","(UNITS)","($)"
1144 PRINT
```

Illustration 10
(concluded)

```
MODELA  13:31            83.02.17
1150 PRINT 'MAXIMUM PROFIT'
1160 PRINT 'OR MINIMUM LOSS','----------','----------','----------'
1165 PRINT
1170 PRINT 'PROFIT (LOSS) BUT NOT'
1172 PRINT 'MAXIMUM (MINIMUM)', '----------','----------','---------'
1178 PRINT
1180 PRINT 'BREAK-EVEN OR'
1190 PRINT 'NEAR-BREAKEVEN','----------','----------','----------'
1200 PRINT
1210 PRINT 'LOSS BUT'
1220 PRINT 'NOT SHUT-DOWN',,'----------','----------','----------'
1230 PRINT
1240 PRINT 'SHUT-DOWN',,'----------','----------','----------'
1250 PRINT
1260 PRINT 'PLOT THE ABOVE INFORMATION RELATED TO THE MONETARY COST'
1270 PRINT 'OF PRODUCTION AND THE ESTIMATED SALES SCHEDULE'
1280 PRINT 'TOGETHER ON A REGULAR GRAPH PAPER.'
1290 PRINT
2000 END

Ready
```

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Illustration 11

X-B: Economic Decisions: A General Model from Real Cost to Monetary Cost with An Estimated Sales Schedule

```
OLD
Old file name--MODELA

Ready

RUN
MODELA  09:34           83.03.07

                                        NAME:? CFJT

PROBLEM NO:? XIII-B-2


ECONOMIC DECISIONS OF A FIRM ON PRICE, QUANTITY PRODUCED
AND SOLD FOR MAXIMUM PROFIT (MINIMUM LOSS), BREAK-EVEN,
LOSS BUT NOT SHUT-DOWN, AND SHUT-DOWN CONDITIONS.

ASSUMPTIONS FOR COSTS OF PRODUCTION IN THE SHORT-RUN:

(1) ASSUME THAT THE TOTAL AMOUNT OF FIXED FACTORS OF
PRODUCTION (FFP) REQUIRED =? 2
(2) ASSUME  THAT THE PRICE PER UNIT OF FFP=? 15
(3) ASSUME THAT THE MAXIMUM AMOUNT OF VARIABLE FACTOR OF
PRODUCTION (VFP) THAT THIS FIRM CAN USE WITHOUT
ENCOUNTERING A SMALLER TOTAL PRODUCTION (NEGATIVE
MARGINAL RETURNS)=? 12
(4) ASSUME THAT THE PRICE PER UNIT OF VFP=? 5
(5)ASSUME THAT THE MARGINAL OUTPUT ASSOCIATED WITH EACH
OF THE ADDITIONAL VFP IS AS FOLLOWS:(START WITH ZERO BECAUSE
WITHOUT THE USE OF VFP THERE WOULD BE ZERO OUTPUT.)
? 0
? 6
? 7
? 10
? 15
? 12
? 10
? 8
? 7
? 6
? 5
? 4
? 3
```

Illustration 11
(continued)

BASED ON THE ABOVE INFORMATION, THE PRODUCTION FUNCTION IN REAL TERMS FOR THIS FIRM IN TERMS OF MARGINAL OUTPUT (MO);, TOTAL OUTPUT (TO), AND AVERAGE OUTPUT (AO) PER UNIT OF VFP CAN BE SHOWN AS FOLLOWS:

FFP (UNITS)	VFP (UNITS)	MO (UNITS)	TO (UNITS)	AO (UNITS)
2	0	0	0	0
2	1	6	6	6
2	2	7	13	6.5
2	3	10	23	7.66
2	4	15	38	9.5
2	5	12	50	10
2	6	10	60	10
2	7	8	68	9.71
2	8	7	75	9.37
2	9	6	81	9
2	10	5	86	8.6
2	11	4	90	8.18
2	12	3	93	7.75

FURTHERMORE, BASED ON THE ABOVE DATA, THE PRODUCTION COST IN MONETARY TERMS SUCH AS TOTAL FIXED COST (TFC), TOTAL VARIABLE COST (TVC), TOTAL COST (TC), AVERAGE FIXED COST (AFC), AVERAGE VARIABLE COST (AVC), AVERAGE TOTAL COST (AC), AND MARGINAL COST (MC) FOR DIFFERENT LEVELS OF OUTPUT CAN BE SHOWN AS FOLLOWS:'

TO (O)	TFC ($)	TVC ($)	TC ($)	AFC ($)	AVC ($)	AC ($)	MC ($)
0	30	0	30	0	0	0	0
6	30	5	35	5	.83	5.83	.83
13	30	10	40	2.3	.76	3.07	.71
23	30	15	45	1.3	.65	1.95	.5
38	30	20	50	.78	.52	1.31	.33
50	30	25	55	.6	.5	1.1	.41
60	30	30	60	.5	.5	1	.5
68	30	35	65	.44	.51	.95	.62
75	30	40	70	.4	.53	.93	.71
81	30	45	75	.37	.55	.92	.83
86	30	50	80	.34	.58	.93	1
90	30	55	85	.33	.61	.94	1.25
93	30	60	90	.32	.64	.96	1.66

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Illustration 11
(continued)

```
NOW ESTIMATE SALES PRICE THAT MAY BE POSSIBLE TO SELL
THE DIFFERENT AMOUNT OF OUTPUT SHOWN ABOVE:

? 4
? 3.5
? 3
? 2.2
? 1.5
? 1.2
? 1
? .8
? .5
? .4
? .25
? .2
? .15

WITH THE ABOVE ESTIMATED SALES SCHEDULE, ITS CORRESPONDING
TOTAL REVENUE (TR), AVERAGE REVENUE (AR), AND MARGINAL
REVENUE (MR) ASSOCIATED WITH DIFFERENT LEVELS OF SALES
CAN BE SHOWN AS FOLLOWS:
```

PRICE ($)	QUANTITY (UNITS)	TR ($)	AR ($)	MR ($)
4	0	0	----	----
3.5	6	21	3.5	3.5
3	13	39	3	2.57
2.2	23	50.6	2.2	1.16
1.5	38	57	1.5	.42
1.2	50	60	1.2	.25
1	60	60	1	0
.8	68	54.4	.8	-.7
.5	75	37.5	.5	-2.42
.4	81	32.4	.4	-.85
.25	86	21.5	.25	-2.18
.2	90	18	.2	-.88
.15	93	13.95	.15	-1.35

Illustration 11
(concluded)

```
BASED ON THE ABOVE REVENUE AND COST CONDITIONS, FIND
SALES PRICE, QUANTITY PRODUCED AND SOLD FOR MAXIMUM
PROFIT (MINIMUM LOSS), BREAK-EVEN OR NEAR-BREAK-EVEN,
LOSS BUT NOT SHUT-DOWN, AND SHUT-DOWN CONDITIONS.

                          SALES          QUANTITY OR     PROFIT OR
                          PRICE          RANGE OF Q      LOSS (-)
                          ($)            (UNITS)         ($)

MAXIMUM PROFIT
OR MINIMUM LOSS           ----------     ----------      ----------

PROFIT (LOSS) BUT NOT
MAXIMUM (MINIMUM)         ----------     ----------      ---------

BREAK-EVEN OR
NEAR-BREAKEVEN            ----------     ----------      ----------

LOSS BUT
NOT SHUT-DOWN             ----------     ----------      ----------

SHUT-DOWN                 ----------     ----------      ----------

PLOT THE ABOVE INFORMATION RELATED TO THE MONETARY COST
OF PRODUCTION AND THE ESTIMATED SALES SCHEDULE
TOGETHER ON A REGULAR GRAPH PAPER.

Ready


BYE
Confirm: YES
Saved all disk files: 284 blocks in use, 216 free
Job 22 User 140,0 logged off KB25 at 83.03.07  09:37
System RSTS V7.0-07 Lebanon Valley
Run time was 6.1 seconds
Elapsed time was 5 minutes
Good morning
```

Illustration 12

X.B. ECONOMIC DECISIONS OF A FIRM ON MAXIMUM PROFIT (MINIMUM LOSS), BREAK-EVEN AND SHUT-DOWN: A GENERAL MODEL FROM REAL COST TO MONETARY COST WITH AN ESTIMATED SALES SCHEDULE. Model I.

* Computer Program Name: #MODEL A

* Given the following information on (1) the costs of productions and (2) the estimated sales schedule, find the economic decisions on sales price (s), and quantities produced and sold for maximum profit (minimum loss), break-even, and shut-down.

NO.	TOTAL AMOUNT OF FIXED FACTORS OF PRODUCTION (UNITS)	PRICE PER UNIT OF FIXED FACTORS OF PRODUCTION ($)	MAXIMUM AMOUNT OF VARIABLE FACTOR OF PRODUCTION USED (UNITS)	PRICE PER UNIT OF VARIABLE FACTOR OF PRODUCTION ($)	MARGINAL OUTPUT OF ADDITIONAL VARIABLE FACTOR OF PRODUCTION USED (UNITS)	ESTIMATED SALES PRICE FOR DIFFERENT AMOUNT OF OUTPUT ($)
X.B.1	18	$5	10	$5	constant at 3 units	fixed at $7.66
X.B.2	18	$5	10	$5	constant at 3 units	fixed at $1.50
X.B.3	18	$5	10	$5	constant at 3 units	fixed at $1.66
X.B.4	18	$5	10	$5	constant at 3 units	fixed at $2.00
X.B.5	10	$9	15	$5	constant at 3 units	fixed at $6.66
X.B.6	9	$2.5	13	$10	constant at 3 units	fixed at $5.00
X.B.7	15	$6	20	$3	constant at 3 units	fixed at $1.50
X.B.8	45	$2	18	$5	constant at 10 units	fixed at $.60
X.B.9	23	$3.99	49	$26.40	constant at 30 units	fixed at $1.80
X.B.10						

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Illustration 13

XI.B. ECONOMIC DECISIONS OF A FIRM ON MAXIMUM PROFIT (MINIMUM LOSS), BREAK-EVEN AND SHUT-DOWN: A GENERAL MODEL FROM REAL COST TO MONETARY COST WITH AN ESTIMATED SALES SCHEDULE. Model II.

* Computer Program Name: #MODEL A

* Given the following information on (1) the costs of productions and (2) the estimated sales schedule, find the economic decisions on sales price (s), and quantities produced and sold for maximum profit (minimum loss), break-even, and shut-down.

NO.	TOTAL AMOUNT OF FIXED FACTORS OF PRODUCTION (UNITS)	PRICE PER UNIT OF FIXED FACTORS OF PRODUCTION ($)	MAXIMUM AMOUNT OF VARIABLE FACTOR OF PRODUCTION USED (UNITS)	PRICE PER UNIT OF VARIABLE FACTOR OF PRODUCTION ($)	MARGINAL OUTPUT OF ADDITIONAL VARIABLE FACTOR OF PRODUCTION USED (UNITS)	ESTIMATED SALES PRICE FOR DIFFERENT AMOUNT OF OUTPUT ($)
XI.B.1	29	2.5	13	2	constant at 5 units	14,13,12,11, 10,9,8,7,6,5, 4,3,2,1
XI.B.2	29	2.5	11	2	constant at 5 units	6,5.5,5,4.5, 4,3.5,3,2.5, 2,1.5,1,.5
XI.B.3	18	5	9	5	constant at 3 units	10,9,8,7,6, 5,4,3,2,1
XI.B.4	10	5	9	5	constant at 3 units	10,9,8,7,6 5,4,3,2,1
XI.B.5	20	5	15	5	constant at 4 units	10,9,8,7,6,5, 4,3,2,1,.9, .8,.7,.6,.5, .4
XI.B.6	18	5	9	2	constant at 3 units	10,9,8,7,6, 5,4,3,2,1
XI.B.7	18	7	9	2	constant at 3 units	10,9,8,7,6, 5,4,3,2,1
XI.B.8	5	1,000	20	240	constant at 12 units	7,000.6,000, 5750,5,500 5250,5000, 4750,4500, 4250,4000, 3750,3500, 3250,3000, 2750,2500, 2250,2000, 1750,1500, 1250
XI.B.9						

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Illustration 14

XII.B. ECONOMIC DECISIONS OF A FIRM ON MAXIMUM PROFIT (MINIMUM LOSS), BREAK-EVEN AND SHUT-DOWN: A GENERAL MODEL FROM REAL COST TO MONETARY COST WITH AN ESTIMATED SALES SCHEDULE. Model III.

* Computer Program Name: #MODEL A

* Given the following information on (1) the costs of productions and (2) the estimated sales schedule, find the economic decisions on sales price (s), and quantities produced and sold for maximum profit (minimum loss), break-even, and shut-down.

NO.	TOTAL AMOUNT OF FIXED FACTORS OF PRODUCTION (UNITS)	PRICE PER UNIT OF FIXED FACTORS OF PRODUCTION ($)	MAXIMUM AMOUNT OF VARIABLE FACTOR OF PRODUCTION USED (UNITS)	PRICE PER UNIT OF VARIABLE FACTOR OF PRODUCTION ($)	MARGINAL OUTPUT OF ADDITIONAL VARIABLE FACTOR OF PRODUCTION USED (UNITS)	ESTIMATED SALES PRICE FOR DIFFERENT AMOUNT OF OUTPUT ($)
XII.B.1	10	5	17	3	0,6,7,9,15,14, 13,12,11,10, 9,8,7,6,5,4, 3,2,	Fixed at $.75
XII.B.2	10	5	17	3	0,6,7,9,15,14, 13,12,11,10,9, 8,7,6,5,4,3,2	Fixed at $.33
XII.B.3	10	5	17	3	0,6,7,9,15,14, 13,12,11,10,9, 8,7,6,5,4,3,2	Fixed at $.50
XII.B.4	10	5	17	3	0,6,7,9,15,14, 13,12,11,10,9, 8,7,6,5,4,3,2	Fixed at $.25
XII.B.5	10	5	17	3	0,6,7,9,15,14, 13,12,11,10,9, 8,7,6,5,4,3,2	Fixed at $1.00
XII.B.6	10		14	5	0,6,7,10,15, 12,10,8,7,6,5, 4,3,2,1	Fixed at $2.00
XII.B.7	10	3	14	5	0,6,7,10,15, 12,10,8,7,6,5, 4,3,2,1	Fixed at $.41
XII.B.8	14	4	14	6	0,8,9,12, 17,14,12,10, 9,8,7,6,5,4,3	Fixed at $2.50
XII.B.9	22	4	9	4.50	0,2,8,7,6,5, 4,3,2,1	Fixed at $1.88
XII.B.10						

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(Prof. C. F. Joesph Tom)

XIII.B. ECONOMIC DECISIONS OF A FIRM ON MAXIMUM PROFIT (MINIMUM LOSS), BREAK EVEN AND SHUT DOWN: A GENERAL MODEL FROM REAL COST TO MONETARY COST WITH AN ESTIMATED SALES SCHEDULE. Model IV.

* Computer Program Name: #MODEL A

* Given the following information on (1) the costs of productions and (2) the estimated sales schedule, find the economic decisions on sales price(s), and quantities produced and sold for maximum profit (minimum loss), break-even, and shut-down.

NO.	TOTAL AMOUNT OF FIXED FACTORS OF PRODUCTION (UNITS)	PRICE PER UNIT OF FIXED FACTORS OF PRODUCTION ($)	MAXIMUM AMOUNT OF VARIABLE FACTOR OF PRODUCTION USED (UNITS)	PRICE PER UNIT OF VARIABLE FACTOR OF PRODUCTION ($)	MARGINAL OUTPUT OF ADDITIONAL VARIABLE FACTOR OF PRODUCTION USED (UNITS)	ESTIMATED SALES PRICE FOR DIFFERENT AMOUNT OF OUTPUT ($)
XIII.B.1	10	3	14	5	0,6,7,10,15,12,10, 8,7,6,5,4,3,2,1	1.40,1.30,1.20,1.10,1.00, .90,.80,.70,.60,.50,.40, .30,.20,.10,.05
XIII.B.2	2	15	12	5	0,6,7,10,15,12,10, 8,7,6,5,4,3	4.00,3.50,3.00,2.20,1.50, 1.20,1.00,.80,.50,.40, .25,.20,.15
XIII.B.3	5	6	13	5	0,6,7,10,15,12,10, 8,7,6,5,4,3,2	5.00,4.00,3.00,2.50,2.00, 1.70,1.50,1.35,1.20,1.00, .50,.40,.30,.20
XIII.B.4	14	3	13	1	0,6,7,10,15,12,10, 8,7,6,5,4,3,2	5.00,4.00,3.00,2.50,2.00, 1.70,1.50,1.35,1.20,1.00, .50,.40,.30,.20
XIII.B.5	9	2	13	6	0,6,7,10,15,12,10, 8,7,6,5,4,3,2	5.00,4.00,3.00,2.50,2.00, 1.70,1.50,1.35,1.20,1.00, .50,.40,.30,.20
XIII.B.6	20	12	13	10	0,9,13,30,27,22,19, 14,10,7,4,3,2,1	100,95,90,85,80,75,70,65, 60,55,50,45,40,35
XIII.B.7	20	12	13	10	0,12,16,33,30,25,22, 17,13,10,7,6,5,3	100,95,90,85,80,75,70,65, 60,55,50,45,40,35
XIII.B.8	20	18	13	14	0,12,16,33,30,25,22, 17,13,10,7,6,5,3	100,95,90,85,80,75,70,65, 60,55,50,45,40,35
XIII.B.9	20	18	13	14	0,12,16,33,30,25,22, 17,13,10,7,6,5,3	1.30,1.25,1.20,1.15,1.10, 1.05,1.00,.95,.90,.85,.80, .75,.70,.65
XIII.B.10						

Illustration 15

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